

What is claimed is:

1. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film on an insulating surface;

forming an insulating film on said semiconductor film; introducing *B* dopant impurity into said semiconductor film through said insulating film by ion doping; and

heating said crystalline semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located in said insulating film.

Sub
2. A method according to claim 1 wherein said insulating film comprises silicon oxide.

3. A method according to claim 1 wherein said dopant impurity is phosphorus.

Sub
4. A method according to claim 1 wherein said dopant impurity is boron.

Sub C2

5. A method according to claim 1 wherein said semiconductor film comprises polycrystalline silicon.

B

6. A method according to claim 3 wherein said phosphorus is supplied by phosphine gas.

Sub E1

7. A method according to claim 4 wherein said boron is supplied by diborane gas.

8. A method according to claim 1 further comprising a step of removing said insulating film.

Sub B2

9. A method according to claim 1 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

10. A method according to claim 1 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

Sub E1

11. A method according to claim 1 further comprising a step of irradiating a laser light to said crystalline semiconductor film.

12. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film on an insulating substrate;

forming an insulating film on said semiconductor film; introducing a dopant impurity into said semiconductor film through said insulating film by ion doping; and

irradiating a laser light to said semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located in said insulating surface.

13. A method according to claim 12 wherein said insulating film comprises silicon oxide.

14. A method according to claim 12 wherein said dopant impurity is phosphorus.

15. A method according to claim 12 wherein said dopant impurity is boron.

16. A method according to claim 12 wherein said semiconductor film comprises polycrystalline silicon.

17. A method according to claim 14 wherein said phosphorus is supplied by phosphine gas.

18. A method according to claim 15 wherein said boron is supplied by diborane gas.

19. A method according to claim 12 further comprising a step of removing said insulating film.

20. A method according to claim 12 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

21. A method according to claim 12 wherein said semiconductor device ^B comprises a shift resistor circuits made of thin-film transistors.

22. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film on an insulating surface;

forming an insulating film on said semiconductor film; introducing a dopant impurity into said semiconductor film through said insulating film by ion doping; and

Sub B₄
heating said crystalline semiconductor film to
activate said dopant impurity,

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wherein a peak of a concentration profile of said
dopant impurity is located above said insulating film.

Sub E₁
23. A method according to claim 22 wherein said
insulating film comprises silicon oxide.

D
24. A method according to claim 22 wherein said dopant
impurity is phosphorus.

Sub E₁
25. A method according to claim 22 wherein said dopant
impurity is boron.

J
Sub C₄
26. A method according to claim 22 wherein said
semiconductor film comprises polycrystalline silicon.

B
27. A method according to claim 24 wherein said
phosphorus is supplied by phosphine gas.

Sub B₁
28. A method according to claim 25 wherein said boron
is supplied by diborane gas.

*Sub
E!*

29. A method according to claim 22 further comprising
a step of removing said insulating film.

*Sub.
B⁵*

30. A method according to claim 22 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

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31. A method according to claim 22 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

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*Sub
E!*

32. A method according to claim 22 further comprising a step of irradiating a laser light to said crystalline semiconductor film.

*Sub.
B⁶*

33. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film on an insulating substrate;

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forming an insulating film on said semiconductor film;
introducing a dopant impurity into said semiconductor film through said insulating film by ion doping; and
irradiating a laser light to said semiconductor film to activate said dopant impurity,

*for
B₂
bond.*

wherein a peak of a concentration profile of said dopant impurity is located above said insulating surface.

34. A method according to claim 33 wherein said insulating film comprises silicon oxide.

35. A method according to claim 33 wherein said dopant impurity is phosphorus.

36. A method according to claim 33 wherein said dopant impurity is boron.

37. A method according to claim 33 wherein said semiconductor film is a polycrystalline semiconductor film.

38. A method according to claim 35 wherein said phosphorus is supplied by phosphine gas.

39. A method according to claim 36 wherein said boron is supplied by diborane gas.

40. A method according to claim 33 further comprising a step of removing said insulating film.

sub.
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41. A method according to claim 33 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

42. A method according to claim 33 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

43. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film having a portion to become a channel region on an insulating surface;

forming an insulating film on said semiconductor film; introducing a dopant impurity into at least said portion through said insulating film by ion doping; and heating said crystalline semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located in said insulating film.

44. A method according to claim 43 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

*sub
B1
cont.*

45. A method according to claim 43 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

*Sub
E1*

46. A method according to claim 43 wherein said concentration is within a range from 5×10^{15} atoms/cm³ to 5×10^{17} atoms/cm³.

47. A method according to claim 43 further comprising a step of irradiating a laser light to said crystalline semiconductor film.

*Sub
B8*

48. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film having a portion to become a channel region on an insulating surface;

forming an insulating film on said semiconductor film; introducing a dopant impurity into at least said portion through said insulating film by ion doping; and irradiating a laser light to said semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located in said insulating surface.

(ab.)
B8
C8d.

49. A method according to claim 48 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

50. A method according to claim 48 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

51. A method according to claim 48 wherein said concentration is within a range from 5×10^{15} atoms/cm³ to 5×10^{17} atoms/cm³.

52. A method of manufacturing a semiconductor device comprising the steps of:

(ab.)
B9

forming a crystalline semiconductor film having a portion to become a channel region on an insulating surface;

forming an insulating film on said semiconductor film; introducing a dopant impurity into at least said portion through said insulating film by ion doping; and

heating said crystalline semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located above said insulating film.

Sub. 7
B9
53. A method according to claim 52 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

54. A method according to claim 52 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

Sub E1
55. A method according to claim 52 wherein said concentration is within a range from 5×10^{15} atoms/cm³ to 5×10^{17} atoms/cm³.

Sub. 10
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56. A method according to claim further comprising a step of irradiating a laser light to said crystalline semiconductor film.

57. A method of manufacturing a semiconductor device comprising the steps of:

forming a crystalline semiconductor film having a portion to become a channel region on an insulating surface;

forming an insulating film on said semiconductor film; introducing a dopant impurity into at least said portion through said insulating film by ion doping; and irradiating a laser light to said semiconductor film to activate said dopant impurity,

wherein a peak of a concentration profile of said dopant impurity is located above said insulating surface.

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58. A method according to claim 57 wherein said semiconductor device comprises active matrix devices made of thin-film transistors.

59. A method according to claim 57 wherein said semiconductor device comprises a shift resistor circuits made of thin-film transistors.

60. A method according to claim 57 wherein said concentration is within a range from 5×10^{15} atoms/cm³ to 5×10^{17} atoms/cm³.

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B"

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Add C1
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